Projects and Progress To Date

Strategies for Pollutant Load Reduction. In the North and Central IRL, several long-term strategies were enacted at the inception of the SWIM program (1987/88) to control the major sources of nutrient and suspended solids loadings. The treatment of non-point surface water drainage is foremost among the strategies to effect significant reductions in pollutant loadings. Other strategies include muck source control, muck sediment removal, and further improvements in domestic waste management via remediation of septic tank problem areas and further reductions of treated waste discharge to the IRL.

Non-point Source Strategy – Surface Water Drainage. Water quality treatment and volume reduction of non-point surface water drainage, along with a comprehensive erosion control program, are the key steps toward significant pollution abatement, especially in the Central IRL (segments IR 9-21). Increases in pollutant loading rates since 1943 in both the North and Central IRL are not surprising (Figures 5-8 and 5-9), but the magnitude of the loading increase in the Central IRL poses greater environmental harm and management challenges than in the North IRL.

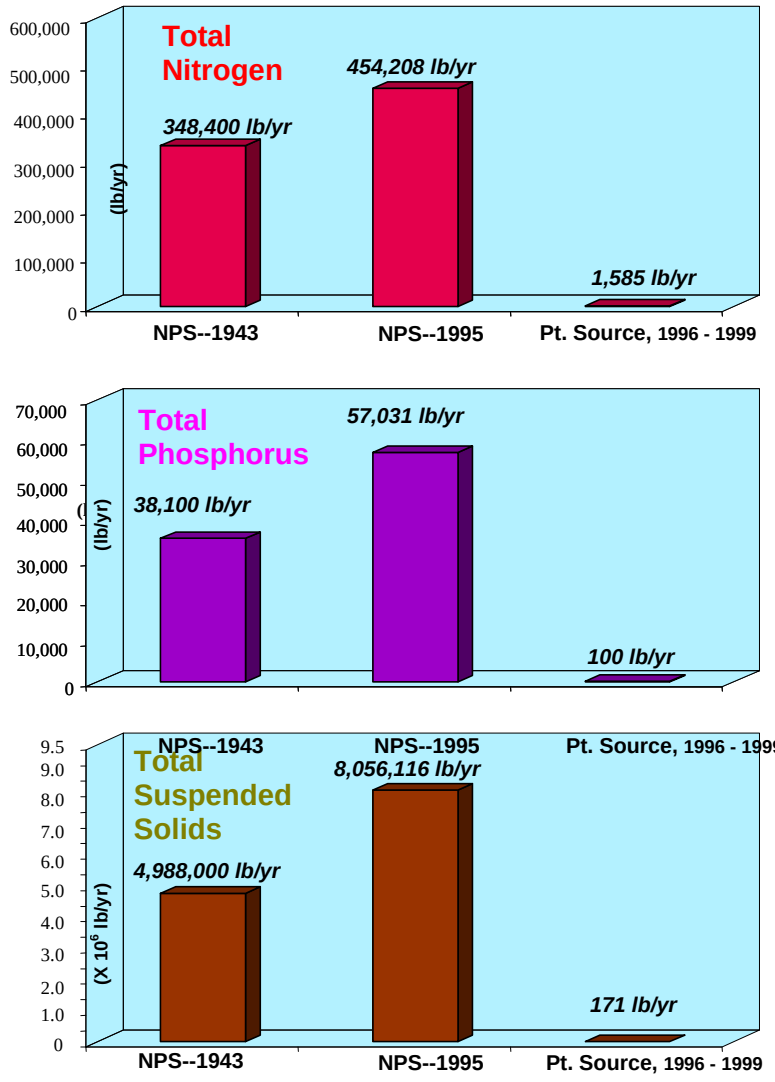


Figure 5-8. North IRL
surface water TN, TP, & TSS loading* comparisons:

- **1943 vs. 1995 Non-point source (NPS) run-off loadings**
- **1995 NPS vs. annual point source or domestic WWTP loadings.**

þ **The 1943 loading estimates are adopted as provisional PLRGs; intended for planning purposes only.**

*NPS loadings estimates derived from SJRWMD's IRL-specific Pollutant Load Screening Model (PLSM). Loadings do not include atmospheric and groundwater inputs. Point source loadings are from domestic WWTPs derived from FDEP records.

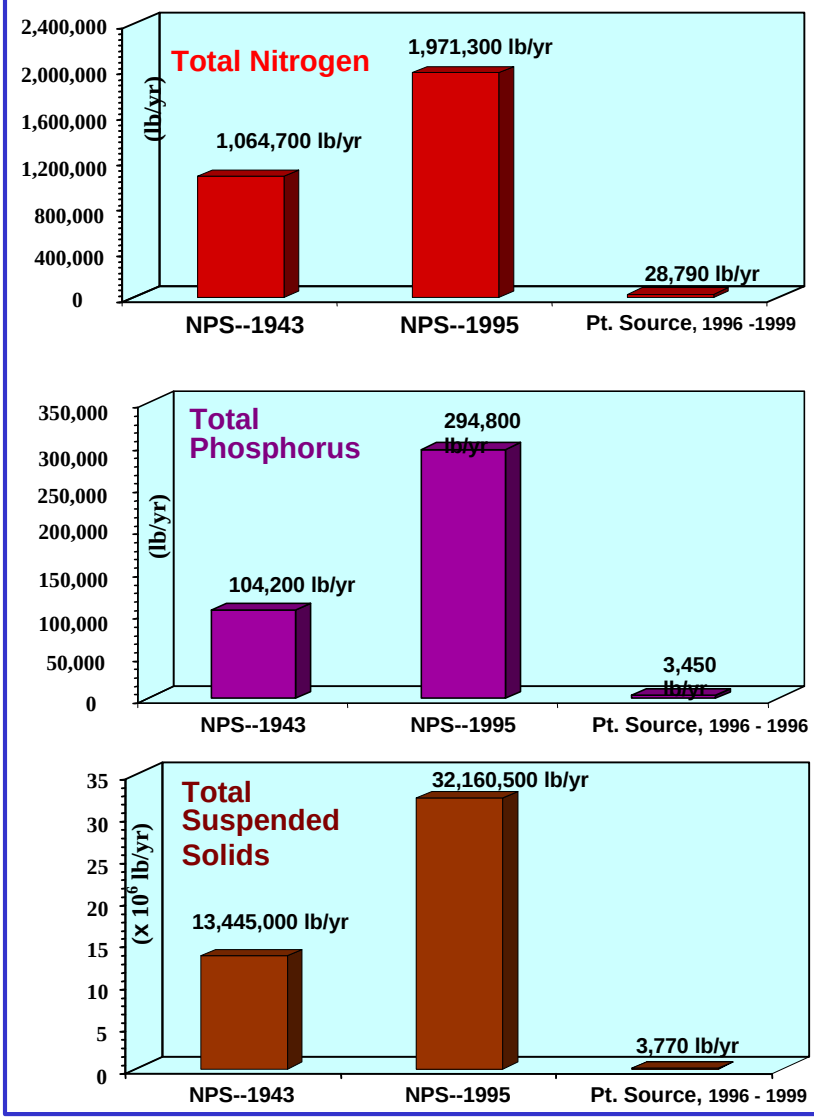


Figure 5-9. Central IRL surface water TN, TP, & TSS loading* comparisons:

- **1943 vs 1995 Non-point source (NPS) run-off loadings**
- **1995 NPS vs annual point source or domestic WWTP loadings**

þ **The 1943 loading estimates are adopted as provisional PLRGs; intended for planning purposes only.**

*NPS loadings estimates derived from SJRWMD's IRL-specific Pollutant Load Screening Model (PLSM). Loadings do not include atmospheric and groundwater inputs. Point source loadings are from domestic WWTPs derived from FDEP records.

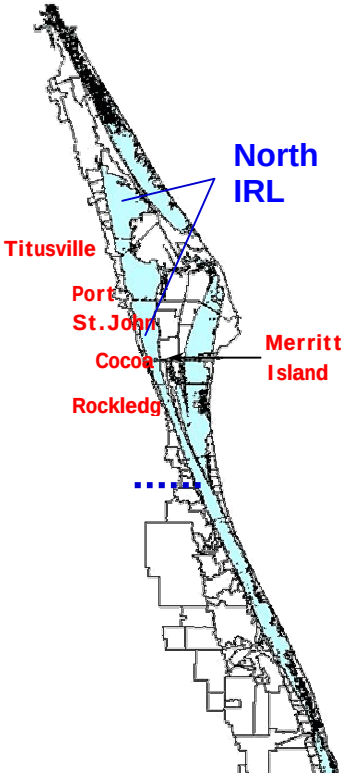
The current or estimated1995 annual loadings of nutrients and TSS to the Central IRL are 3 to 6 times higher than the annual loadings to the North IRL (Figures 5-8 and 5-9) and 6 to 15 times higher than to either the Banana River Lagoon or Mosquito Lagoon! The main reasons for this large disparity in loading rates is that the Central IRL is home to more numerous and more developed tributary sub-basins, several of which have been enlarged 15% to 700% beyond their natural boundaries by major drainage diversion projects that were constructed between 1920 and 1970[9]. In the Central IRL, non-point pollution abatement plans that address the larger sub-basins and their inter- and intra-basin drainage projects are a programmatic priority (these sub-basin projects are described in more detail in the next section).

[9] Crane Creek watershed increased ~65% (additional lands within and west of Melbourne Village), Turkey Creek watershed increased ~700% (Melbourne-Tillman Water Control District), Sebastian River watershed increased ~100% (lands draining to Sottile Canal and lands within Vero Lakes and Fellsmere Water Control Districts), and the watershed draining to segment IR16-20 increased ~15% (includes Indian River Farms Water Control District).

In addition to the sub-basin plans and projects, the SJRWMD and IRLNEP foster smaller scale surface water treatment projects in both the North and Central IRL that primarily serve a pollutant reduction purpose; but some projects also improve flood protection of city neighborhoods. For example, over the last 5 years many local governments cost-shared with the SJRWMD and IRLNEP to plan and construct such projects. These local projects are briefly described below (Tables 5-2 and 5-3).

Table 5-2. North IRL basin non-point, surface water treatment projects supported by SJRWMD/IRLNEP and local government funds, 1995 - 2001 (North IRL comprises segments IR1-8: Turnbull basin to Honeymoon Lake, Merritt Island)

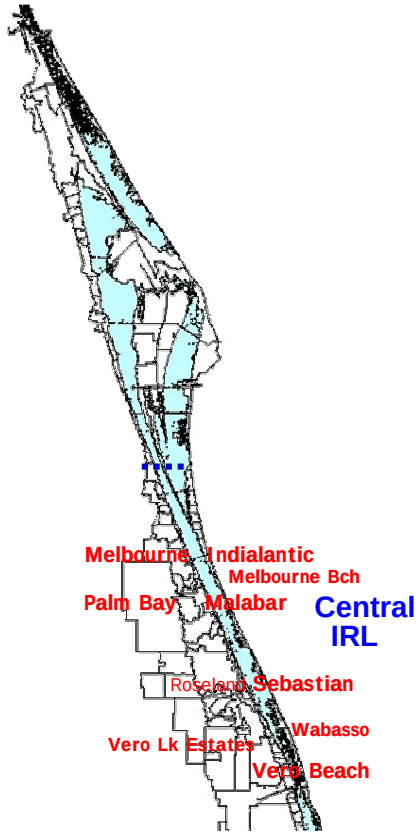
- Titusville
  - *Sand Point Park Marina* -- pond and swales serving ~60 acres of largely commercial development; design removal efficiencies of 94% TSS, 76% TN, and 69% TP for up to 1 inch rainfall
  - *Garden St. basin* – treatment train system (e.g., swales, check dams, inlet skimmers, & baffle boxes) to treat drainage from a 114-acre urban basin
  - *Chain-of-Lakes Stormwater Park* (under design)– large municipal stormwater treatment system with public park amenities.
- *Cocoa –*
  - *Riverfront Park* – installation of 3 baffle boxes and underground storage reservoir to collect stormwater from 30 acres of old downtown, which will be pumped to the city WWTP to supplement the city's reuse supply for lawn irrigation
- *Rockledge –*
  - *Rockledge Dr./Barton Ave./Orange Ave.* – 3 baffle boxes (more are pending) serving ~42 acres of old residential development
- Brevard County and Merritt Island --
  - *Mainland, south of Titusville* – Kennedy Point Yacht Club retention weir intended to trap solids from drainage of a 320-acre basin.
  - *Port St. John, Sunrise Village* – baffle box serving approximately 66 acres of residential land use (captured 150,000 lb of sediment in 6 months)
  - *Port St. John, Broadway Blvd. Detention pond* – off-line detention of drainage from a 127-acre residential area with a design targets of at least 50% reduction in TSS and nutrient loads and with no increase in peak dis*charge for up to a 25-year/24-hour storm event.*



  - *N. Cocoa* – off-line detention basin and diversion structures at Indian Trail near U.S.1 serving 70 acres of rural residential
  - *Merritt Island, Winter Apartment area* – baffle box serving about 3.5 acres of commercial land use (1,670 lb of sediment removed in 8 months)
  - *Merritt Island, Granada St. area* – baffle box serving 100 acres of residential development (6,750 lb of sediment removed in 8 months)
  - *Merritt Island, Merritt Park Place sewer and stormwater drainage upgrades* – connection of over 75 residences and businesses with failing septic systems to central sewer and an upgrade of drainage system with inclusion of stormwater treatment
  - *Merritt Island, curb and grate inlet baskets* -- installed in storm drains throughout the island. Some baskets include oil absorbance pillows.

Table 5-3. Central IRL basin non-point, drainage treatment projects supported by SJRWMD/IRLNEP and local government cost-share funds, 1995 – 2001 (Central IRL comprises segments IR9-21: Honeymoon Lake to St. Lucie/Indian River county line)

- *Melbourne –*
  - *Goode Park Terrace Sediment Control* – paving dirt road & swale construction, provides treatment for ~10 acres of residential land use in Crane Creek sub-basin
- *Malabar –*
  - *Cory St. baffle box* -- affects 23.5 acres of rural residential in Turkey Cr. sub-basin
- *Palm Bay --*
  - *Norwood Street (C-1/ Turkey Creek drainage basin)* – two baffle boxes installed for "tandem" treatment of residential drainage for this 25-acre development
  - *Basin 1 surface water treatment train project (Indian River basin)* – wet detention basin & sediment trap system that serves 100-acre res./com. drainage area.
  - *Basin 7 surface water treatment train project (Turkey Creek/IRL)* – wet detention basin and wetlands treatment serving ~100 acres of res./com. area
- *Indialantic --*
  - *Street Sweeper* -- (also subject of a study to compare efficiencies between street sweeper & baffle boxes); sweeper operates twice monthly collecting ~2,000 lb of sediment per trip
  - *Fourth Ave. to Indian R. Dr.* - swale system constructed that serves 30 acres of moderate to high density residential land use
- *Melbourne Beach –*
  - *Ocean Ave.* -- baffle box, treats ~10 acres of res./com. properties
- *Brevard County --*
  - *Dove St. drainage treatment project* -- (Melbourne, Crane Cr. sub-basin)



- *City of Sebastian --*
  - *Main Street baffle box* -- treats drainage from 5 acres of old downtown Sebastian
  - *Elkcam waterway dam and Stonecrop basin surface water management projects* – flood control and treatment of drainage from southern portion of the City of Sebastian (~2,100 acres).
- *Vero Beach –*
  - *Mockingbird Lane baffle box* -- treats 15 acres residential (drains to Main Canal).
- *Indian River County --*
  - *Vero Lakes Estates (Sebastian River, South Prong)* – modification of upland ponds into more effective wet detention systems; swale improvements included. Expected reduction in TSS annual load by 80% from this 3,871-acre residential development.
  - *Roseland (Collier Creek, a tributary to South Prong of Sebastian River)* – Wet detention system and enlargement of conveyances to reduce flooding and pollutant loading along Bay Street; south detention pond expected to provide 72% reduction in annual TSS loading; *the north detention pond about 65%.*
  - *Gifford Area near City of Sebastian* – Wet detention ponds and improvements to conveyances to improve flood protection, erosion control, should achieve ~50% reduction in TSS and TP annual loadings & ~30% reduction in TN loading.
  - *Wabasso Causeway Park* – shoreline stabilization with native planting & coquina revetments to reduce erosion; dry detention; restroom upgrades with sewer connection.

Sub-basin Water Management Plans (Central IRL). As was previously stated, water management plans concerning the larger sub-basins in the Central IRL are a programmatic priority, particularly those that receive diverted drainage from the Upper St. Johns River Basin. These sub-basins are: Crane Creek, Turkey Creek and Melbourne-Tillman Water Control District (MTWCD), Sebastian River (including the North and South Prongs, Fellsmere Canal and C-54), and Indian River Farms Water Control District (Figure 5-10). The sub-basin plans are in various stages of development, from conceptual design to detailed engineering. Planning is a collaborative effort between the SJRWMD and the local jurisdictions that are the drainage management authorities in these sub-basins -- the cities, counties and water control districts (WCDs).

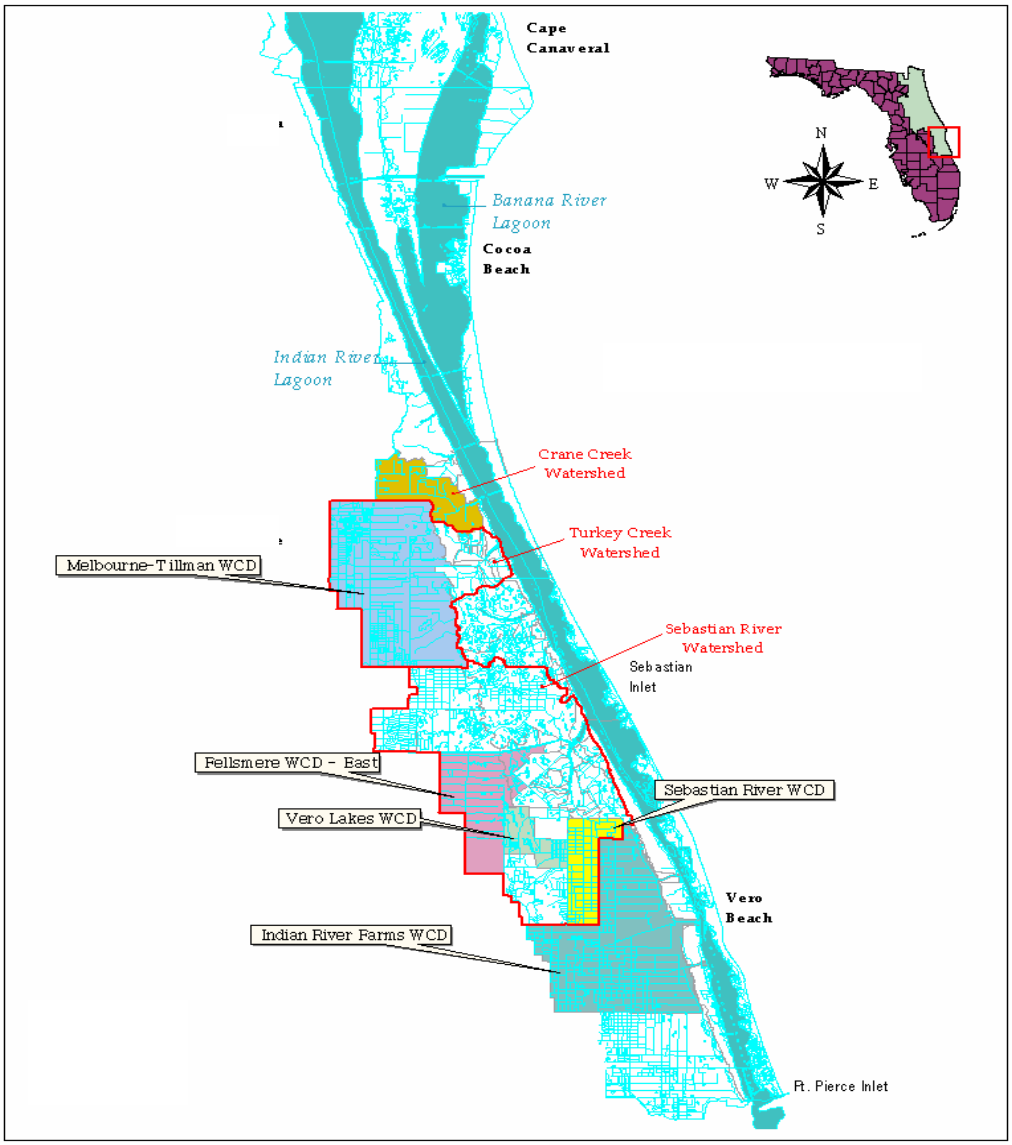


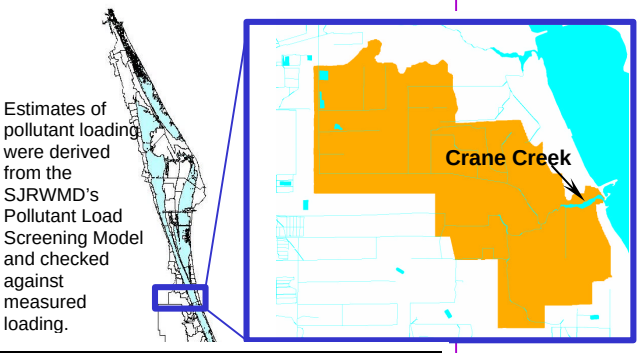
Figure 5-10. Location of Priority Sub-basins and Water Control Districts (WCDs) in the Central IRL

It is the SJRWMD's intent to achieve, to a significant degree, the PLRGs in the Central IRL by implementing sub-basin plans described below. For the time being and until *final* PLRGs are established, *provisional* PLRGs are recommended as planning targets. Provisional PLRGs are generally based on estimated 1943 loading rates calculated by the SJRWMD Pollutant Load Screening Model (Adamus and Bergman, 1995). This model was slightly modified to better match land use conditions in the IRL Basin. The provisional PLRGs or "allowable" loading rates are intended to be fairly conservative; thus, the design of stormwater treatment systems based on those targets should be able to meet final PLRGs. It is assumed that by meeting 1943 loading rates, water quality and clarity in the affected lagoon segments should improve sufficiently to enable seagrasses to expand to the 1943 coverage, the historical coverage target for most IRL segments (which is very close to the 1.7 m depth target).

The SJRWMD would like to develop cooperative funding partnerships with local governments, water control districts, and U.S. Army Corps of Engineers (via the IRL-North Feasibility Study) to implement these sub-basin plans as long as they adequately address either provisional or final PLRGs. The partnership arrangement can even be expanded to cover other water issues as part of the PLRG strategy process and be included in a sub-basin plan. Some of these other water issues may include improved flood protection, water supply, and groundwater protection.

Provided below are the description and status of each of the sub-basin planning projects in the Central IRL: Crane Creek, Turkey Creek/MTWCD, Sebastian River, and Indian River Farms WCD.

Crane Creek. Crane Creek is a major tributary to the Central IRL draining a developing 21 sq mi urban watershed. The Creek conveys drainage from Melbourne, Melbourne Village, most of West Melbourne, and some unincorporated areas whose drainage is managed by Brevard County. Between 1920 and 1965, the watershed area was expanded westward, taking in about 7 sq mi beyond the Ten-Mile Ridge[10] as a consequence of development. (It was more expedient and hydraulically effective to have drainage canals cut to Crane Creek rather than to the St. Johns River marshes.)



Estimates of pollutant loading were derived from the SJRWMD's Pollutant Load Screening Model and checked against measured loading.

Crane Cr. Sub-basin	***TN*** *lb/ac/yr*	***TP*** *lb/ac/yr*	***TSS*** *lb/ac/yr*
Est. 1995 loading	8.7	1.1	178
"allowable" loading target	4.4*	0.6*	<50**

* provisional, based on 50% reduction of current loadings (c. 1995), and approximates c. 1943 loading rates

** provisional TSS target based on 75% reduction level, which is below c. 1943 loading rates

The combined effects of drainage improvements and urban development -- augmenting creek flows and runoff pollutant concentrations – have

[10] Ten-Mile Ridge is one of the major hydrologic divides between the IRL and the Upper St. Johns River basins. The other, more significant divide is the Atlantic Coastal Ridge, which is within 1 to 2 miles west of the IRL.

significantly elevated annual loadings of nutrients and TSS. For example, from 1943 to 1995, loadings increased as follows: ~66,000 to 117,000 lb/yr TN; ~6,000 to 15,000 lb/yr TP; and ~963,000 to 2.4 million lb/yr TSS. The Crane Creek sub-basin generates the highest areal loading rates (lb/ac/yr) of any sub-basin in the IRL system. And, by the time the Crane Creek sub-basin is built out, the 1995 pollutant loadings will have increased by an additional 20%.

What is being done to reverse this trend; that is, what is being done to effect pollutant load reductions while population growth and development continue? This challenge is being addressed through a surface water management planning effort, whose dual mission is improved drainage and the water quality treatment of drainage waters. Plan development is spearheaded by Brevard County, with financial assistance and technical reviews provided by SJRWMD. It is intended that both agencies will pool their financial resources, both general revenue and external funding sources (state and federal), to carry out the plan. The cities in the watershed will also be encouraged to participate since they will definitely be beneficiaries of an implemented plan.

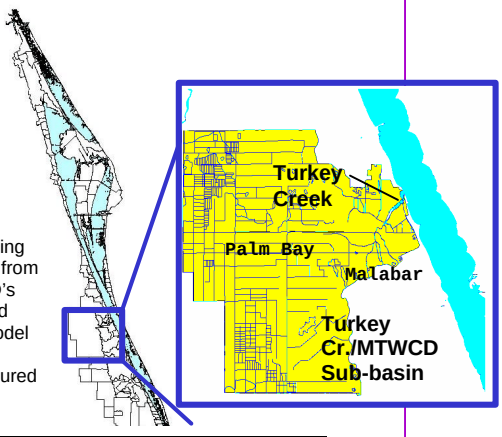
From the standpoint of flood protection, it is clear that the western portion of the watershed will receive serious attention. The drainage infrastructure in certain western areas where the flood risk is high will require significant retrofit to meet both water quantity and quality objectives. Toward that end, sizeable parcels of western lands may need to be acquired in order to construct facilities to store and treat drainage waters. Lands are quite scarce in the eastern half of the watershed where it is more heavily developed and populated; therefore, smaller scale drainage treatment projects incorporated within the existing drainage conveyances would be a likely consideration. Furthermore, given the enormous increase in suspended solids loading and muck build-up over time, a comprehensive soil erosion control program should be established in this sub-basin. This program should target development construction, existing development, and drainage canal side-slope erosion[11].

Brevard County recently prepared a proposed watershed plan. This plan describes management alternatives and costs designed to meet up to a 50% reduction in the current annual loading of pollutants (c. 1995)[12]. The reduction levels are translated as "allowable" loading rates which should be achieved even under build-out conditions. Based on a 50% reduction level, the provisional "allowable" loading targets for Crane Creek sub-basin would approximate 4.4 lb/ac/yr TN and 0.6 lb/ac/yr TP. The targets approach the c. 1943 loading rates, more so for TN than TP. Since TSS is a critical pollutant of concern, at least 75% reduction of current loading (c. 1995) is recommended by SJRWMD. That translates to an "allowable" loading of <50 lb/ac/yr, which approximates the c. 1943 loading rate for TSS.

[11] Although it is not typically thought of as a suspended solids reduction strategy, the dredging of Crane Creek's lower reach in 1998 was intended to re-create, to some extent, the creek's sediment trapping capability. That capability serves to reduce the suspended solids loading to the IRL. This strategy could be defined as a BMP if the creek "trap" is periodically dredged. For more information please refer to the section in this chapter entitled *Non-point Source Strategy – Muck*.

[12] Crane Creek's 50% reduction target meets the 1943 loading rates for TN, but not for TP and TSS. A higher, 75% reduction target for TSS should be pursued. More stringent targets may not be economically achievable considering the high level of development in the sub-basin. The PLR Model will help evaluate whether the "50% or 75%" targets can satisfy the seagrass restoration goal for the area.

Turkey Creek/MTWCD. The Turkey Creek/MTWCD sub-basin represents a classic example of an *inter-basin diversion* project, i.e., a drainage development project that diverts drainage from one basin to another. Turkey Creek's drainage area was expanded 10 miles beyond its natural western boundary taking in about 98 sq mi of the Upper St. Johns River Basin (USJRB) floodplain and marshes. This expansion began in the 1920s and continued well into the 1960s under the authority and management of the Melbourne-Tillman Water Control District (MTWCD). As a result, the Turkey Creek watershed was effectively enlarged seven-fold!



Estimates of pollutant loading were derived from the SJRWMD's Pollutant Load Screening Model and checked against measured loading.

TurkeyCr/ MTWCD	*TN lb/ac/yr*	*TP lb/ac/yr*	*TSS lb/ac/yr*
Est.1995 loading	6.2	0.5	80
"allowable" loading target*	1.9	0.2	32

*provisional, meets c.1943 levels

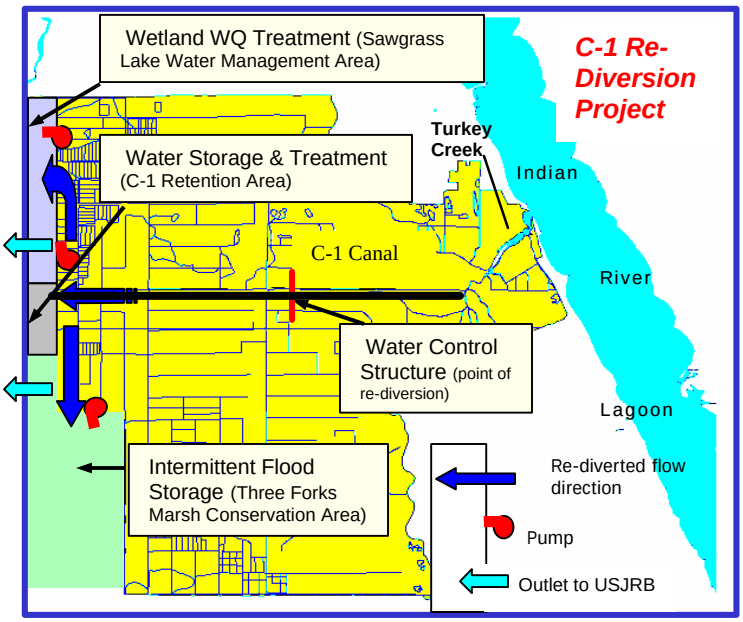
Over 90% of the annual volume of fresh water and 68% to 80% of the annual loadings of nutrient (N and P) and suspended solids that are discharged through Turkey Creek are contributed by the MTWCD's primary canal, C-1 (Trefry and Feng, 1991; SJRWMD unpublished PLSM[13] data, 1994). These unnaturally large volumes of fresh water and pollutant loads released from C-1 are impacting salinity and water quality and, in turn, the seagrasses within a 10 to 20 sq mi area of the adjacent Lagoon. Additionally, large releases of drainage water impacted the economically significant hard clam fishery in the 1980s and 1990s. Storm events frequently triggered C-1 discharges in excess of 500 million gallons/day for several consecutive days. Discharges at that magnitude and duration, occurring year after year, contributed to the decline in the hard clam fishery (*Mercenaria mercenaria*) because of the clam's sensitivity to prolonged drops in salinities[14].

Therefore, to significantly reduce Turkey Creek's impact on the IRL, tighter restrictions on discharge from C-1 canal are necessary. Freshwater, nutrient, and suspended solids reduction targets are established for C-1 as well as for other, lesser inflows to Turkey Creek. The targets and the plans to achieve them have taken years to develop through diagnostic investigations, evaluations of water management alternatives and costs, and analyses of secondary benefits and impacts (e.g., water supply, groundwater, and recreation). Of course, the SJRWMD has not acted alone. The MTWCD, U.S. Army Corps of Engineers (USACE) and the municipalities of Palm Bay and Malabar are actively engaged with SJRWMD in planning and implementation activities.

[13] PLSM is the Pollution Load Screening Model developed by SJRWMD (Adamus and Bergman, 1993). PLSM results were used in conjunction with results from Trefry and Feng (1991) to provide Turkey Cr. sub-basin loading estimates.

[14] For example, salinity below 20 parts per thousand for several days duration is potentially injurious or lethal to hard clam larvae (Davis, 1958; Chanley, 1958).

The primary strategy in this sub-basin is the C-1 *re*-diversion project, which is jointly funded and conducted by the SJRWMD, MTWCD, and USACE. Other important strategies – the water management plans of Palm Bay and Malabar, and the muck removal project in the creek's lower reach[15] -- are intended to work in tandem with the C-1 re-diversion project to achieve the overall PLRGs for Turkey Creek. The purpose of the re-diversion project is to re-divert as much of the MTWCD's C-1 drainage to the west (see map to the left). As currently planned, the re-diverted water will enter a storage/treatment cell (C-1 Retention Area: 1,280 acres) at the western terminus of C-1. From there, water will be pumped to the north end of a created wetland system (Sawgrass Lake Water Management Area: approximately 2,500 acres) and be allowed to gravity-flow southward through the system for water quality treatment. The treated water can then be released in a controlled manner to the USJRB. Flood waters can be further controlled by directing C-1 drainage southwest to the Three Forks Marsh Conservation Area in addition to the C-1 Retention Area and Sawgrass Lake WMA. The completion date set by the USACE for project construction is 2006.



The C-1 re-diversion project is currently designed to meet freshwater discharge and salinity targets and to achieve the majority of the targeted reductions in nutrient and suspended solids loads from the creek to the IRL. Targets limiting C-1 storm discharges are expressed as maximum discharges that would be allowed but not be exceeded under certain storm conditions. For example, under the current C-1 re-diversion design, C-1 discharges greater than 452 million gallons/day (700 ft^3/s) would occur no more frequently than once every 5 years. Discharges below those levels will certainly help meet the salinity targets. Presently, under average annual rainfall conditions, discharges up to or above 650 million gallons/day (1000 ft^3/s) usually occur at least once every year! In other words, the C-1 re-diversion project should go far toward meeting a desirable salinity regime in the portion of the Lagoon affected by Turkey Creek discharges.

With regard to annual nutrient and TSS loadings, an ambitious "up-to-80%" reduction target is established. Actually, any reduction above 60% would be a remarkable achievement. The water management opportunities to effect such a significant reduction are present in this sub-basin, probably more than in the other developed IRL sub-basins. Substantial reductions in pollutant loads (50% or more) would be accomplished by the C-1 re-diversion project and its planned reductions in C-1 storm discharges (above) and

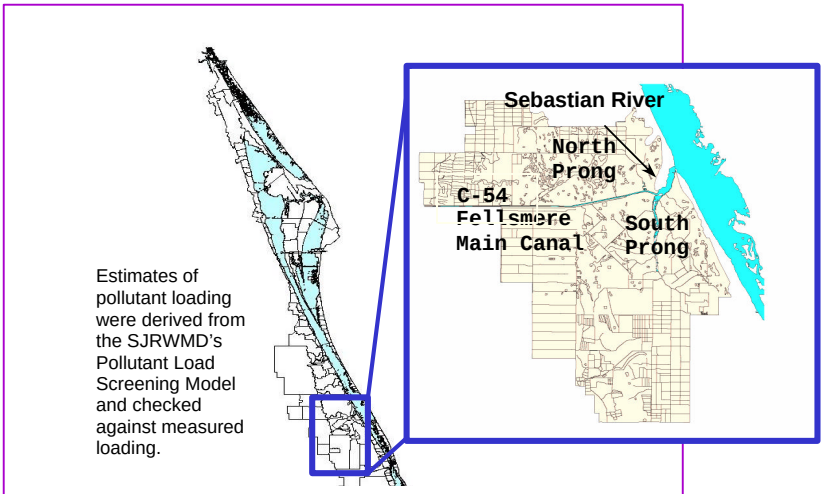
[15] Dredging of Turkey Creek's lower reach, completed in 2001, is intended to re-create the creek's sediment trapping capability. That capability serves to reduce the suspended solids loading to the IRL. For more information please refer to the section in this chapter entitled *Non-point Source Strategy – Muck*.

base flows[16]. The balance of the targeted reductions can be handled under stormwater programs managed by Palm Bay and Malabar and a canal side-slope erosion control program managed by MTWCD. Both municipalities are presently working on plans for that purpose as well as for improved flood control.

These municipal water management plans identify projects that would improve neighborhood drainage, reduce flood risk, and provide the drainage quality treatment required to meet PLRGs. Several of these projects in Palm Bay are constructed; many more are being planned in Palm Bay, as they are in Malabar. It's possible that some of the larger projects, requiring sizeable parcels of land, can be utilized as parks for recreation and for environmental education (these projects are called "stormwater parks"). Constructed projects in Palm Bay and Malabar are listed above in Table 5-3.

Erosion of canal side-banks is probably a major source of the suspended solids delivered to the creek and into the IRL. Therefore, a comprehensive erosion control program, with special emphasis on canals, will become a major initiative carried out by the MTWCD and the municipalities (please refer to section entitled *Next 5 years*).

Sebastian River. The Sebastian River sub-basin is the largest drainage area in the Central IRL, approximately 172 sq mi., and the second largest in the entire IRL basin, behind the St. Lucie River. The magnitude of Sebastian River's annual loading (c. 1995 - 1999) of nutrient and TSS (~300,000 to 650,000 lb/yr TN, ~33,000 to 100,000 lb/yr TP, and 3 to 7 million lb/yr TSS) easily exceeds that of either Crane or Turkey Creeks. Since 1943, Sebastian's largest increases in annual loadings are in phosphorus followed by suspended solids (>100% and >40%, respectively). These loading increases are due to inter-basin diversions of drainage and land development (agricultural and urban).



Estimates of pollutant loading were derived from the SJRWMD's Pollutant Load Screening Model and checked against measured loading.

Sebastian River	***TN*** *lb/ac/yr*	***TP*** *lb/ac/yr*	***TSS*** *lb/ac/yr*
Est.1995 loading	5.9	0.93	83
"allowable" loading target*	5.2	0.4	<50

*provisional, meets c. 1943 levels

[16] Base flows may be thought of as non-storm flows. For this project, a base flow is statistically defined as a monthly or seasonal average flow.

The South Prong and Fellsmere Main Canal contribute most (roughly 60%) of Sebastian's annual average discharge[17] and pollutant loading to the Lagoon. North Prong's flow constitutes 20-25% of Sebastian's annual discharge. C-54's contribution makes up most of the remainder, but its annual discharge volume has been substantially reduced over the last 7 years.

The diminished flows from C-54 are due to the work completed in the Upper St. Johns River Basin project (SJRWMD/USACE), enabling greater volumes of flood water to be stored in the project's constructed reservoirs and restored marshes rather than be released through C-54 to "tide". Consequently, the South Prong, Fellsmere Canal, and North Prong drainage areas are receiving more water management attention for the sake of the Sebastian River and IRL estuaries.

Several planning projects are underway in the South Prong, Fellsmere, and North Prong drainage areas to meet multiple water resource objectives – primarily salinity maintenance, and nutrient and solids reductions (i.e., PLRGs), followed by improved flood control, irrigation water supply, and groundwater protection. The plans are specific to the City of Sebastian (South Prong), Sebastian River WCD (South Prong), Vero Lakes Estates and Vero Lakes WCD (South Prong), Fellsmere WCD – East (Fellsmere Canal), and the Sottile Canal/North Prong drainage.

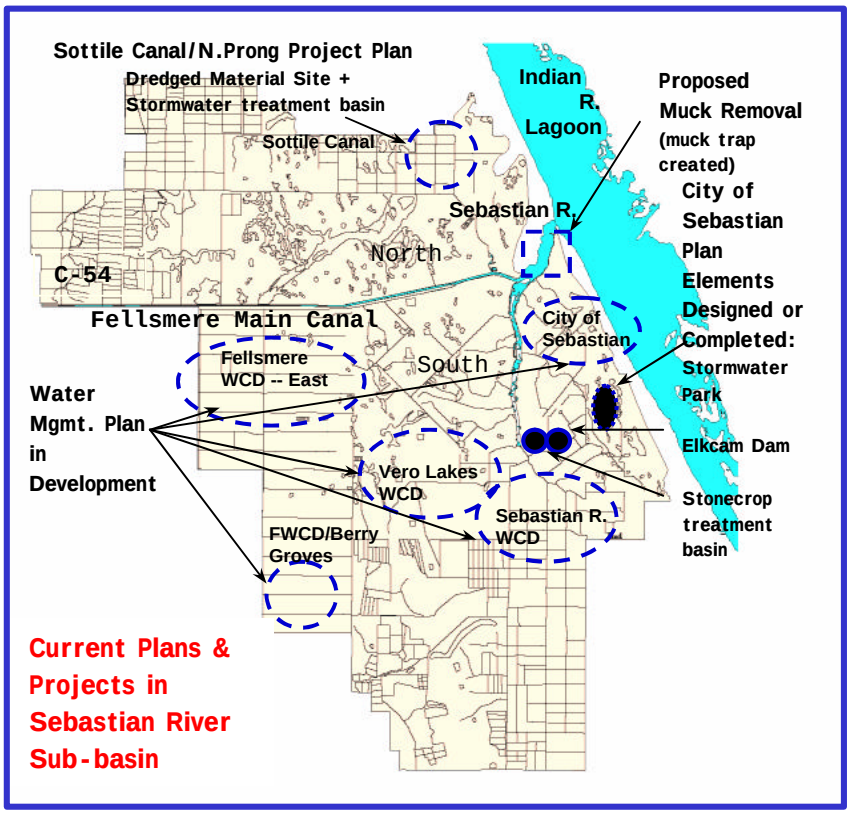
Discharge and water quality criteria are being established by the SJRWMD for guiding the development of each plan, from the conceptual level to the construction design level. Abiding by such criteria will help ensure that all plans, when implemented together, will meet the basin-wide salinity targets and PLRGs for the Sebastian/IRL system. Salinity targets (seasonal minimum and/or maximum) are recommended for the upper, middle, and lower reaches of Sebastian River and for the adjacent IRL. Concomitant with the salinity targets, discharge criteria will then be developed for each of the major drainage canals (e.g., Fellsmere, C-54, Lateral C canal of Sebastian River WCD, etc.).

Provisional pollutant reductions or "allowable" loadings (lb/ac/yr) for each planning project area are also recommended. They will be verified and possibly revised during the final PLRG process. Taken together, the pollutant reductions assigned to each planning area are intended to meet the basin-wide, provisional "allowable" loading rates (c. 1943) for TN, TP, and TSS: 5.2 lb/ac/yr, 0.44 lb/ac/yr, and <50 lb/ac/yr, respectively. Meeting those "allowable" loading rates would mean a basin-wide reduction of *build-out* loads (c. 2010 – 2020) by 25% TN, 44% TP, and 60% TSS.

In general, there are measures that can be shared in common by all plans to meet the basin-wide discharge criteria and PLRGs. For example, an erosion control program should be spelled out in each plan with an emphasis on canal bank stabilization. The widening and re-sloping of canals to provide additional drainage storage and erosion control should be considered. Erosion control and turbidity standards could be strengthened in construction/development ordinances and in WCD rules. The WCDs could impose drainage standards on new development to limit volume and peak discharge rates. The replacement of the "bottom-release" radial gate structures with "top-over" structures (e.g., vertical slide gates) is recommended for all WCDs and for C-54/S-157 to further reduce sediment scour and transport.

[17] For the period 1990 – 1999, Sebastian River annually discharged about 55 billion gallons (± 10 billion gallons). By comparison, Turkey Creek's annual discharge was roughly 30 to 40 billion gallons.

Each plan will also include management elements specific to its area and its resource issues (see map to the right). The City of Sebastian (7,185-acre area) is well into its surface water master planning to meet both pollutant reduction (e.g., up to 65% reduction of 1995 TSS loading) and flood control criteria. Certain master plan elements are already constructed and operational – the treatment pond that serves the Stonecrop drainage area (838 acres) and the improvement of the water control structure or dam on the Elkcam Canal.



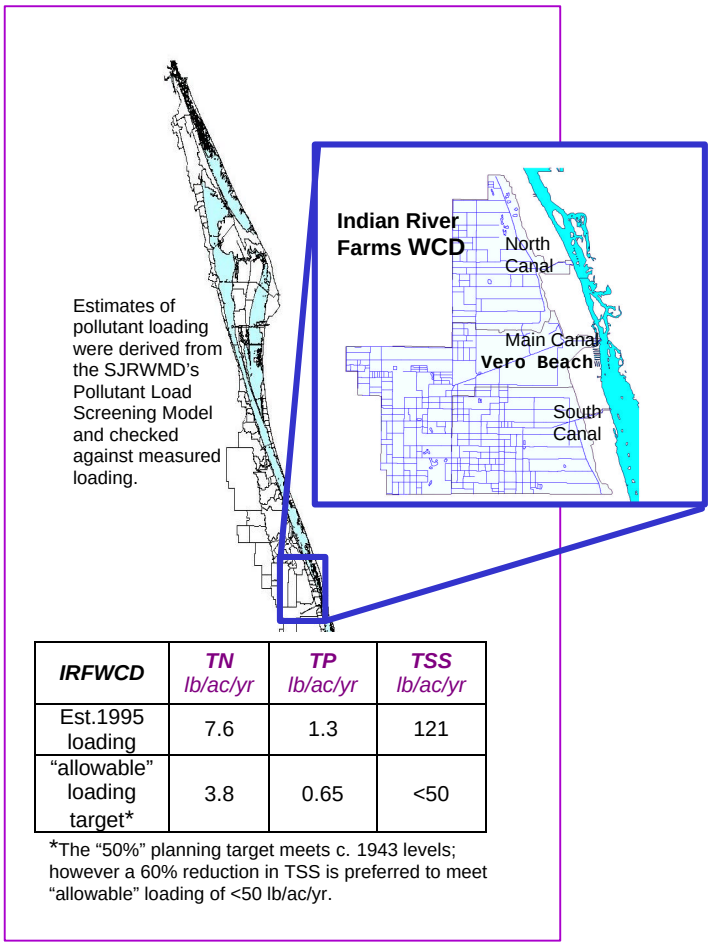
The SJRWMD is designing a 150-acre stormwater park to treat drainage within the southern portion of the City of Sebastian. The treatment area in the park is a 60-acre wet detention/dry retention facility intended to serve a 1,300-acre residential area. Re-creational amenities will also be designed into the park. The City will be responsible for operation and maintenance of the park facility and will provide partial reimbursement to the SJRWMD for land acquisition costs.

Conceptual planning is in progress for Sebastian River WCD, Vero Lakes WCD, and Fellsmere WCD. Management strategies and arrangements for cost-share and technical collaboration are being discussed between the SJRWMD, WCDs, and USACE. Management strategies include those common measures described above (e.g., erosion control program), and more costly initiatives like storage/treatment reservoirs and additional water control structures. Other benefits may be gained by implementing such strategies: increased stability in irrigation water supply and less dependence on groundwater for irrigation. Decreased withdrawal of groundwater also helps to reduce the intrusion of salt water into the aquifer.

In the North Prong drainage area, the SJRWMD recently purchased 496 acres of land that straddles the lower portion of Sottile Canal. A sizeable portion of the land will be set aside to sufficiently treat the drainage from the projected build-out (e.g., Barefoot Bay and other developments). About one-third of more of the land will be used to manage dredged material as part of the Sebastian River muck removal project. Dredging the lower to middle reaches of Sebastian River will remove a majority of the organic-enriched, oxygen-depleting muck and will also re-create deeper areas along the river

bottom to trap sediment and eroded soils (please read the following section *Non-point Source Strategy – Muck* for more details).

Indian River Farms WCD. Interlaced with hundreds of miles of canals and ditches, this 80 sq mi water control district drains about a 50/50 mix of citrus agriculture and urban growth within and surrounding Vero Beach. The Indian River Farms WCD (IRFWCD) is an example of a large, efficient *intra*-basin[18] drainage project whose 35 billion gallons/yr discharge to the IRL rivals that of Turkey Creek. Discharge from IRFWCD is delivered by three primary canals – North, Main, and South Canals – affecting approximately 12 miles or more of one of the more narrow segments of the Lagoon. As previously described, this Vero Beach segment exhibits some of the worst water quality and seagrass resource conditions in the IRL system (along with the Cocoa-Melbourne segment). This segment's color, TSS, and TP levels are generally some of the highest recorded among all IRL segments (for more details, please read this chapter's section on **Seagrass and Water Quality**: *Water Quality Assessment*). What really sets the IRFWCD apart from the other Lagoon sub-basins is its heavy loading of TP, nearly 70,000 lb/yr. This TP loading is even higher than the loading from the Turkey Creek/MTWCD sub-basin, which is about 1.5 times the size of the IRFWCD!



IRFWCD	*TN lb/ac/yr*	*TP lb/ac/yr*	*TSS lb/ac/yr*
Est.1995 loading	7.6	1.3	121
"allowable" loading target*	3.8	0.65	<50

*The "50%" planning target meets c. 1943 levels; however a 60% reduction in TSS is preferred to meet "allowable" loading of <50 lb/ac/yr.

A planning team composed of representatives from the SJRWMD, Indian River County, IRFWCD, Vero Beach, the county extension service of IFAS[19], and consultants was organized in early 2001 to deal with "upland solutions" to these problems. At the time of this writing, water management objectives and various management concepts were being developed. With respect to color and TSS, drainage volume reduction and erosion control measures are being considered. Some measures may include those mentioned above relative to other sub-basin/WCD plans (e.g., erosion control program including canal side-slope stabilization, water control structure retro-fits, etc.).

[18] A small western portion of the WCD (~10 sq mi) lies outside the Ten-Mile Ridge or historical IRL basin.

[19] Institute of Food and Agricultural Sciences (IFAS) of the University of Florida provides expert assistance in the fields of agriculture, soils, horticulture, etc. to all counties throughout the state.